WHAT IS CLAIMED IS:

1. A method for altering the electrical characteristics of an organic semiconducting matrix material, the method comprising doping the organic semiconducting matrix material with a metal complex dopant, wherein the metal complex is an n-dopant with regard to the matrix material.

wherein the metal complex constitutes an n-dopant with regard to the matrix material.

2. The method as recited in claim 1, wherein said organic semiconducting matrix material has a central atom selected from the group consisting of a neutral transition metal atom and a charged transition metal atom.

3. The method as recited in claim 2, wherein at least one said central atom of said metal complex has a formal number of valence electrons of 16 or more and/or said metal complex is polynuclear and has at least one metal-metal bond between two said metal central atoms of said metal complex.

4. The method as recited in claim 3, wherein said at least one central atom is bound to a ligand comprising at least one donor atom that is different from an aromatic nitrogen atom as a component of a 6-membered ring.

5. The method as recited in claim 4, wherein at least one of said at least one donor atoms binding to said ligand of said central atom is selected from the group consisting of: B, Al, Ga, In, C, Si, Ge, Sn, Pb, P, As, Sb, Bi, S, Se, Te.

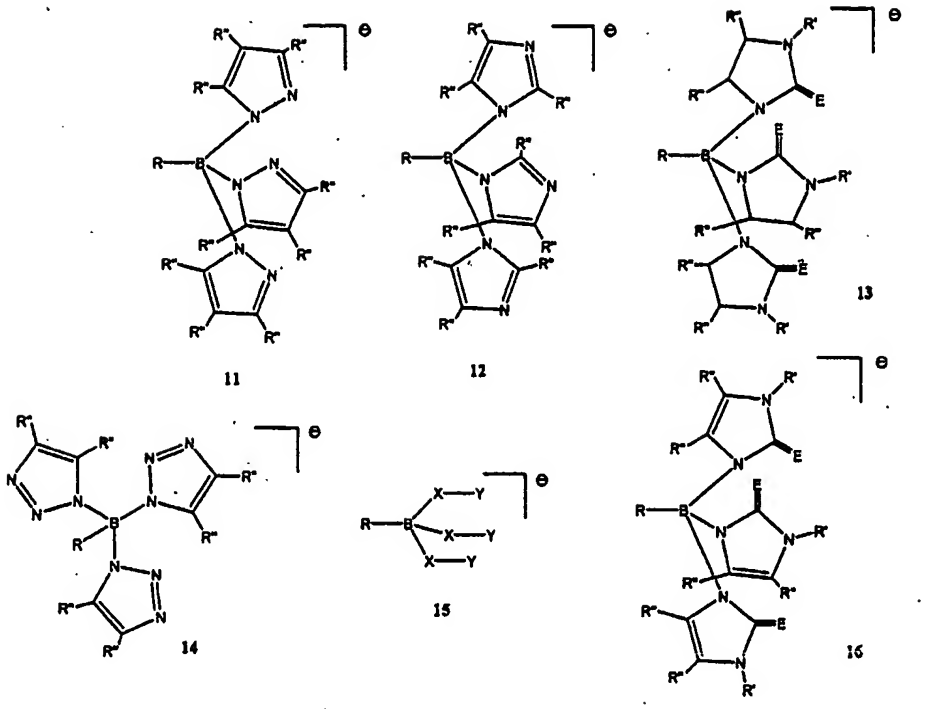
6. The method as recited in claim 4, wherein at least one said ligand forms a $\pi$ complex with said central atom of said metal complex.

7. The method as recited in claim 4, wherein said metal complex is a polynuclear metal complex in which at least one of said ligand coordinates to at least two of said metal central atoms.

8. The method as recited in claim 4, wherein at least one of said ligands of said metal complex is selected from the group consisting of: halides, carboxylates, formamidinates, pyrimido-pyrimidines, hpp and guanidinates.

9. The method as recited in claim 4, wherein at least one of said ligands of said metal complex belongs to the group consisting of: borates, carboranes, triazacycloalkanes, triazacycloalkenes, pyrroles, thiophenes, pyrazoles, imidazoles, thiazoles, oxazoles and fullerenes.

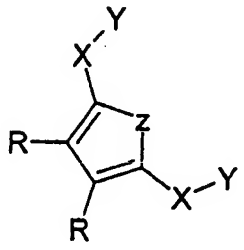
10. The method as recited in claim 9, wherein at least one borate ligand is selected from the group consisting of the following compounds: 11, 12, 13, 14, 16; wherein R, R' and R", independently of one another, are any substituent, including hydrogen; and wherein R, R' and R" can be the same or different in each case; and wherein E is an at least divalent atom or group of atoms:



11. The method as recited in claim 4, wherein said at least one donor atom binding to said at least one metal central atom is a carbanion-carbon atom or, with regard to said ligand, a formally divalent atom selected from the group consisting of: C (carbene), Si (silylene), Ge (germylene), Sn, Pb.

12. The method as recited in claim 11, wherein said formally divalent atom is a component of an aromatic or non-aromatic ring, wherein said ring further possesses the donor atom, and wherein said donor atom further possesses a heteroatom selected from the group consisting of: N, P, As, S, Se or Te.

13. The method as recited in claim 4, wherein at least one said ligand is a compound having a formula selected from the group consisting of: 27, 27a, 28, 28a, 45, 45a, 46 or 46a;



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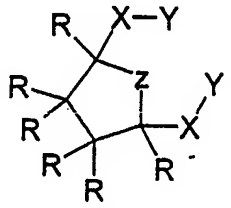

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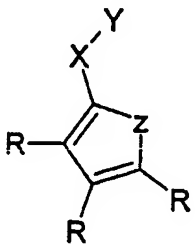

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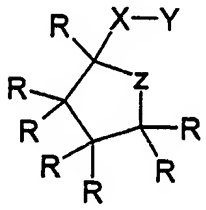

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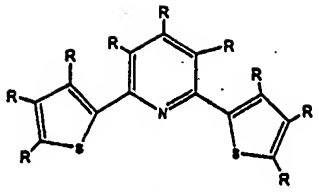
wherein R is, in each case and independently of one another, any substituent, including hydrogen; wherein X is a heteroatom or carbon atom capable of acting as a donor; wherein X is an at least divalent atom or group of atoms; wherein one or two X can also be missing; wherein Z and Y are in each case a carbon or heteroatom capable of acting as a donor; and wherein Z and Y and two Y atoms can be the same as one another or different from one another in each case.

14. The method as recited in claim 4, wherein at least one said ligand is a compound selected from the group consisting of: 20-26, 29-37; wherein R is, in each case and independently of one another, any substituent, including hydrogen; wherein E is an atom selected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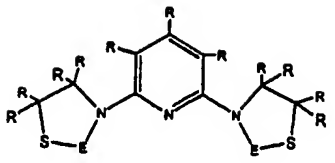
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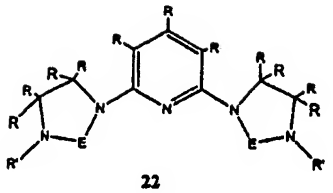
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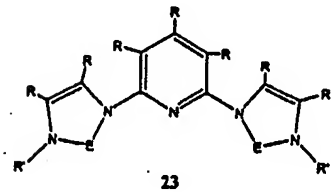
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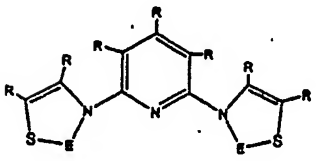
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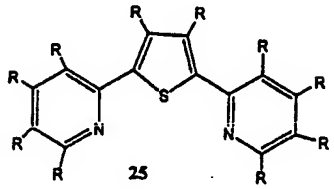
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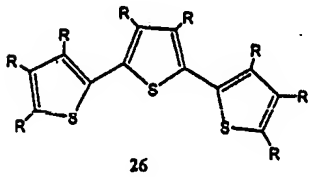
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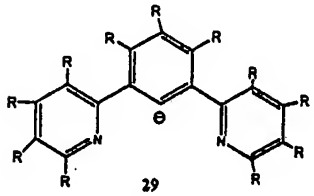
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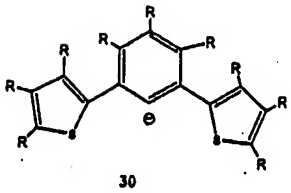
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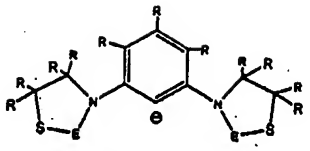
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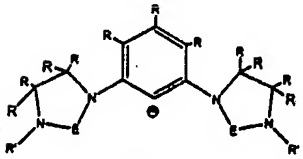
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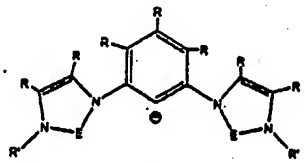
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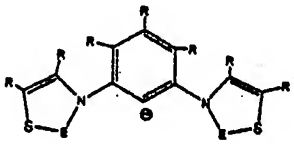
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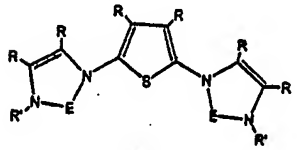
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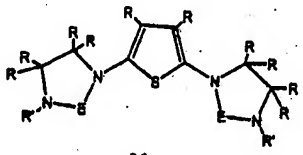
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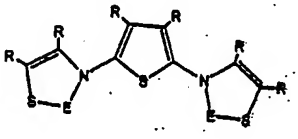
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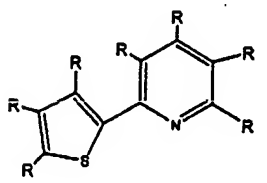
from the group consisting of: C, Si, Ge, Sn, Pb; wherein in each case P, As or Sb can be present, independently of one another, instead of N; and wherein Se or Te can be present, in each case independently of one another, instead of S.

15. The method as recited in claim 14, wherein E is selected from the group consisting of: C (carbene), Si (silylene), and Ge (germylene).

16. The method as recited in claim 4, wherein at least one said ligand is a compound selected from the group consisting of: 39-44, 47-56;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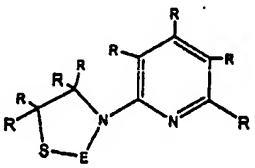
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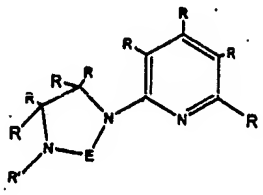
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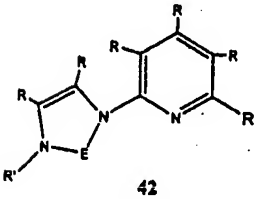
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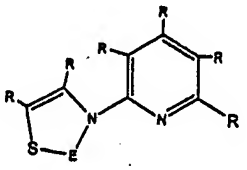
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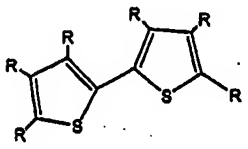
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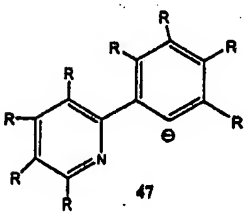
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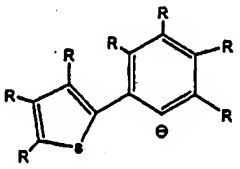
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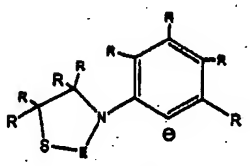
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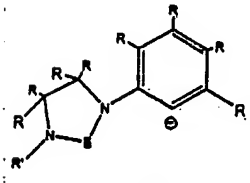
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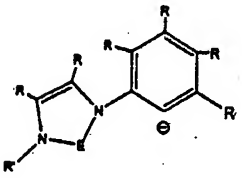
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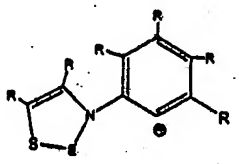
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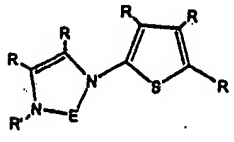
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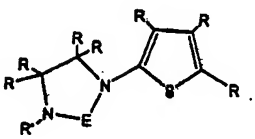
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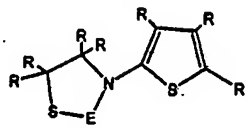
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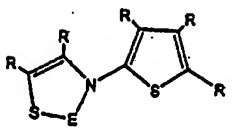
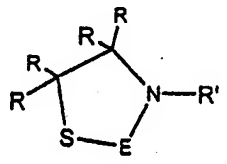

56

wherein R is, in each case and independently of one another, any substituent, including hydrogen; wherein R and R' can be the same or different; wherein E is an atom selected from the group consisting of: C, Si, Ge, Sn, Pb; wherein X is a heteroatom or carbon atom capable of acting as a donor, and in each case independently of one another, P, As or Sb can be present instead of N; and wherein Se or Te can be present, in each case independently of one another, instead of S.

17. The method as recited in claim 15, wherein E is selected from the group consisting of: C (carbene), Si (silylene), and Ge (germylene).

18. The method as recited in claim 4, wherein at least one said ligand is selected from the group consisting of: compounds 59, 60, 61, 62, 63 and 64;



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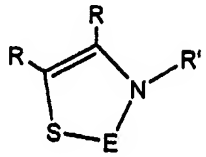

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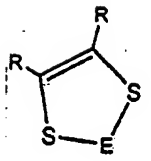

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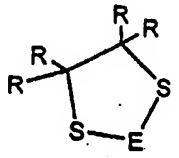

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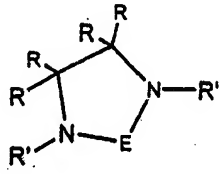

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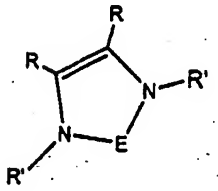

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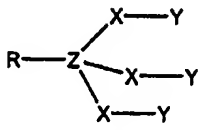
wherein R is, in each case and independently of one another, any substituent, including hydrogen; wherein E is an atom selected from the group consisting of: C, Si, Ge, Sn, Pb; wherein

X is a heteroatom or carbon atom capable of acting as a donor; wherein P, As or Sb can be present instead of N, independently of one another in each case; and wherein Se or Te can be present instead of S, independently of one another in each case.

19. The method as recited in claim 4, wherein at least one said ligand is selected from the group consisting of: compounds 19, 38, 57 or 58; wherein R is, in each case and independently of one another, any substituent, including hydrogen; wherein X is a heteroatom or carbon atom capable of acting as a donor; and wherein P, As or Sb can be used instead of N, independently of one another in each case.

20. The method as recited in claim 12, wherein at least one of said rings carrying said donor atom has at least one or more substituted or unsubstituted alkyl substituents with C2-20.

21. The method as recited in claim 4, wherein at least one said ligand is a tripod ligand having the general structure:

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wherein R is any substituent, including H; wherein R can be identical to the structural sequence -X-Y; wherein X represents an at least divalent atom or a group of atoms with or without heteroatoms; wherein X can be the same or different in each case; wherein Y is a heteroatom or carbon atom capable of acting as a donor; wherein Y can be the same or different and can be part

of a ring; and wherein Z, as the central atom of said tripod ligand, can be any atom, including a metal atom.

22. The method as recited in claim 21, wherein said Y heteroatom is selected from the group comprising: C, N, P, S, Se, Ge, and Sn.

23. The method as recited in claim 1, wherein said metal complex is selected from the group comprising: $M_2hpp_4$, with M selected from the group comprising: Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, or W; $M_2(AlkylCOO)_4$ F with M selected from the group comprising: Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, or W and with alkyl in each case, the same as each other or different from one another, with C1 to C10; $M_2(guanidinate)_4$ with M selected from the group comprising: Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, or W; $M_2(formamidinate)_4$ with M selected from the group comprising: Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, or W; $M_2(carboxylate)_4$ with M selected from the group comprising: Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, or W; $M_2(halide)_4$ with M selected from the group comprising: Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, or W; bis($\eta^5$-cyclopentadienyl)M with M selected from the group comprising: Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, or W; and benzene-M-($\eta^5$-cyclopentadienyl) with M selected from the group comprising: Cr, Mn, Fe, Co, Ni, Cu, Zn, Mo, or W.

24. The method as recited in claim 4, wherein said ligand contains one or more hydrogen atoms and wherein said hydrogen atoms are replaceable by residues, including alkyl residues.

25. The method as recited in claim 1, wherein said metal complex has an ionization potential in the gas phase of less than 6 eV.

26. The method as recited in claim 1, wherein said metal complex has an oxidation potential E(1/2)ox against ferrocene/ferrocenium (Fe/Fe+) of $\leq$ -0.09 V.

27. A product comprising an organic semiconducting material disposed on a substrate, wherein the organic semiconducting material is a semiconducting matrix material doped with a metal complex dopant, and

wherein said organic semiconducting material is disposed of at least one of an electrically contactable layer and an electrical line path arranged on a substrate.

28. The product as recited in claim 27, wherein said organic semiconducting material contains at least one organic matrix compound and an n-dopant, and wherein said n-dopant comprises at least one neutral metal complex.

29. The product as recited in claim 28, wherein the molar doping ratio of said n-dopant to said organic matrix compound or the doping ratio of said dopant to monomeric units of a polymeric matrix molecule is between about 1:1 and about 1:100,000.

30. A process for producing an organic semiconducting material, the process comprising doping an organic matrix molecule with an n-dopant,

wherein said n-dopant is comprised of at least one neutral metal complex.

31. A method for producing an electronic device, the method comprising forming an electronically functionally effective region containing a metal complex and an organic semiconducting material,

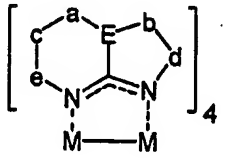
wherein said mental complex is a neutral electron-rich metal complex.

32. An electronic device having an electronically functionally effective region, wherein said electronically effective region comprises an organic semiconducting material and at least one neutral metal complex.

33. An electronic device as recited in claim 32, wherein said electronically effective region has an organic semiconducting matrix material which is doped with at least one n-dopant in order to alter the electronic characteristics of the organic semiconducting matrix material using at least one neutral metal complexes.

34. An electronic device as recited in claim 32, wherein said device is in the form of one of the group consisting of: an organic light-emitting diode (OLED), a photovoltaic cell, an organic solar cell, an organic diode or an organic field effect transistor; wherein said organic semiconducting matrix material is doped with at least one neutral metal complex; and wherein said organic semiconducting matrix material represents said electronically effective part of said electronic device.

35. A dopant for doping an organic semiconducting matrix material having the




Type 65a

following structure:

wherein a = $-CR_1R_2-$, b = $-CR_3R_4-$, c = $-CR_5R_6-$, d = $-CR_7R_8-$ and e = $-CR_9R_{10}-$, where $R_1$, $R_2$, $R_3$, $R_4$, $R_5$, $R_6$, $R_7$, $R_8$, $R_9$ and $R_{10}$ are, at the same time or independently of one another, H, $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, preferably $R_1$, $R_3$, $R_5$, $R_7$, $R_9$ = H and $R_2$, $R_4$, $R_6$, $R_8$, $R_{10}$, = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, $-NR_2$ or -OR, or optionally, a or b or e or d can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, or at c, C is replaced by Si;

wherein the bonds b-d and c-e or b-d and a-c can, at the same time or independently of one another, be unsaturated,

wherein the bonds b-d, a-c and c-e can, at the same time or independently of one another, be part of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn,

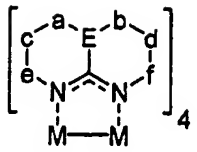
wherein the bonds b-d, a-c and c-e can, at the same time or independently of one another be part of an aromatic or condensed aromatic ring system which can also contain the heteroelements O, S, Se, N,

wherein the atom E is an element from the main group, preferably selected from the group N, P, As, Sb, though without being limited to these,

wherein the structural element a-E-b can be a component of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, or

the structural element a-E-b can be a component of an aromatic ring system which can also contain the heteroelements O, S, Se, N, ,

wherein the metal M is a transition metal, preferably W or Mo;



Type 65b

wherein the structural elements a-f can mean: a = -$CR_1R_2$-, b = -$CR_3R_4$-, c = -$CR_5R_6$-, d = -$CR_7R_8$-, e = -$CR_9R_{10}$- and f = $CR_{11}R_{12}$, where $R_1$, $R_2$, $R_3$, $R_4$, $R_5$, $R_6$, $R_7$, $R_8$, $R_9$, $R_{10}$, $R_{11}$, and $R_{12}$ are hydrogen, $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, preferably $R_1$, $R_3$, $R_5$, $R_7$, $R_9$, $R_{11}$ = H and $R_2$, $R_4$ , $R_6$, $R_8$, $R_{10}$, $R_{12}$ = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, the structure 65b with $R_1$, $R_2$, $R_3$, $R_4$, $R_5$, $R_6$, $R_7$, $R_8$, $R_9$, $R_{10}$, $R_{11}$ and $R_{12}$ = H being excluded from this, or in the structural elements c and/or d, C can be replaced by Si, wherein

a or b or e or f can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, wherein

a and f or b and e can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl,

wherein the bonds a-c, b-d, c-e and d-f, but not simultaneously a-c and c-e and not simultaneously b-d and d-f can be unsaturated,

wherein the bonds a-c, b-d, c-e and d-f can be part of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein

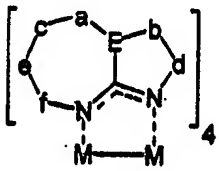
the bonds a-c, b-d, c-e and d-f can be part of an aromatic or condensed aromatic ring system which can also contain the heteroelements O, S, Se, N,

wherein the atom E is an element from the main group, selected from the group N, P, As, Sb, though without being limited to these,

wherein the structural element a-E-b can be a component of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein

the structural element a-E-b can be a component of an aromatic ring system which can also contain the heteroelements O, S, Se, N,

wherein the metal M is one of W, Mo, and a transition metal,




Type 65c

wherein the structural elements a-f can mean: a = $-CR_1R_2-$, b = $-CR_3R_4-$, c = $-CR_5R_6-$, d = $-CR_7R_8-$, e = $-CR_9R_{10}-$ and f = $CR_{11}R_{12}$, where $R_1$, $R_2$, $R_3$, $R_4$, $R_5$, $R_6$, $R_7$, $R_8$, $R_9$, $R_{10}$, $R_{11}$ and $R_{12}$ can, at the same time or independently from one another, be H, $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, preferably $R_1$, $R_3$, $R_5$, $R_7$, $R_9$, $R_{11}$ = H and $R_2$, $R_4$, $R_6$, $R_8$, $R_{10}$, $R_{12}$ = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, wherein

at c or e, C can be replaced by Si, wherein

a or b or d or f can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, wherein

a and d or band f can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl,

wherein the bonds a-c, c-e, e-f and b-d, but not simultaneously a-c, c-e and e-f and not simultaneously a-c and c-e and not simultaneously c-e and e-f can be unsaturated,

wherein the bonds a-c, c-e, e-f and b-d can be part of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein

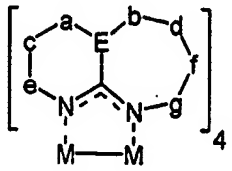
the bonds a-c, c-e, e-f and b-d can be part of an aromatic or condensed aromatic ring system which can also contain the heteroelements O, S, Se, N,

wherein the atom E is an element from the main group, preferably selected from the group N, P, As, Sb, though without being limited to these,

wherein the structural element a-E-b can optionally be a component of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein

the structural element a-E-b can optionally be a component of an aromatic ring system which can also contain the heteroelements O, S, Se, N,

wherein the metal M is a transition metal, preferably W or Mo; or




Type 65d

wherein the structural elements a-g can mean: a = -$CR_1R_2$-, b = -$CR_3R_4$-, c = -$CR_5R_6$-, d = -$CR_7R_8$-, e = -$CR_9R_{10}$-, f = $CR_{11}R_{12}$ and g = $CR_{13}R_{14}$, where $R_1$, $R_2$, $R_3$, $R_4$, $R_5$, $R_6$, $R_7$, $R_8$, $R_9$, $R_{10}$, $R_{11}$, $R_{12}$, $R_{13}$ and $R_{14}$ can, at the same time or independently from one another, be H, $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -

OR, preferably, $R_1$, $R_3$, $R_5$, $R_7$, $R_9$, $R_{11}$, $R_{13}$ = H and $R_2$, $R_4$, $R_6$, $R_8$, $R_{10}$, $R_{12}$, $R_{14}$ = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, or

at c, d and f, though not d and f simultaneously, C can be replaced by Si, wherein

a or b or e or g can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, wherein

a and g or b and e can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl,

wherein the bonds a-c, c-e, b-d, d-f and f-g, but not simultaneously a-c and c-e, and not simultaneously b-d, d-f and f-g, and not simultaneously b-d and d-f, and not simultaneously d-f and f-g, can be unsaturated,

wherein the bonds a-c, c-e, b-d, d-f and f-g can be part of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein

the bonds a-c, c-e, b-d, d-f and f-g can be part of an aromatic or condensed aromatic ring system which can also contain the heteroelements O, S, Se, N,

wherein the atom E is an element from the main group, preferably selected from the group N, P, As, Sb, though without being limited to these,

wherein the structural element a-E-b can optionally be a component of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein

the structural element a-E-b can be a component of an aromatic ring system which can also contain the heteroelements O, S, Se, N

wherein the metal M is a transition metal, preferably W or Mo.

36. A process for preparing a dopant in accordance with claim 35, comprising the steps of:

(a) reacting an inorganic metal salt of the central atom M with a free base of a ligand in an organic solvent in the presence of a reducing agent and heating to reflux,

(b) isolating the dopant product obtained after reacting and drying.

37. The process as recited in claim 36, wherein said solvent is selected from the group consisting of an aromatic solvent and a mixture thereof.

38. The process as recited in claim 36, wherein said solvent is an ether.

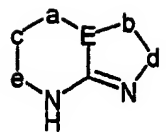
39. The process as recited in claim 38, wherein said ether is chosen from the group consisting of: dialkyl ether, cyclic ether, cyclic- and open-chain polyether.

40. The process as recited in claim 36, wherein said reducing agent is a base metal.

41. The process as recited in claim 40, wherein said base metal is chosen from the group consisting of: sodium, potassium and caesium.

42. The process as recited in claim 36, wherein said isolating step is performed by one of: crystallization, precipitation and sublimation.

43. A ligand for a metal complex, selected from the group consisting of



Type 65a`

wherein the structural elements a-e can mean: a = -$CR_1R_2$-, b = -$CR_3R_4$-, c = -$CR_5R_6$-, d = -$CR_7R_8$- and e = -$CR_9R_{10}$-, where $R_1$, $R_2$, $R_3$, $R_4$, $R_5$, $R_6$, $R_7$, $R_8$, $R_9$ and $R_{10}$ are, at the same time or independently of one another, H, $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, preferably $R_1$, $R_3$, $R_5$, $R_7$, $R_9$ = H and $R_2$, $R_4$, $R_6$, $R_8$, $R_{10}$ = $C_1$ -$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, where the structure 65a' with $R_1$ to $R_{10}$ = H is excluded from this, where the structure 65a' with $R_1$ and $R_2$ = aryl is excluded from this, where in the structure 65a' $R_1$ and $R_{10}$ are always H, wherein

a or b or e or d can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, wherein

a and d or b and e can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, wherein

at c, C is replaced by Si,

wherein the bonds b-d and c-e or b-d and a-c can, at the same time or independently of one another, be unsaturated, wherein the bonds b-d, a-c and c-e can, at the same time or independently of one another, be part of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, where the ligand with c-e = cyclohexyl and cylcohexenyl is excluded from this, or

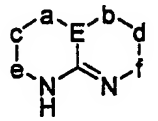
wherein the bonds b-d, a-c and c-e can, at the same time or independently of one another be part of an aromatic or condensed aromatic ring system which can also contain the heteroelements O, S, Se, N, where the ligand in which b-d, a-c and c-e are components of benzene is excluded from this,

wherein the atom E is an element from the main group, preferably selected from the group consisting of N, P, As, Sb, though without being limited to these,

wherein the structural element a-E-b can be a component of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, or

the structural element a-E-b can optionally be a component of an aromatic ring system which can also contain the heteroelements O, S, Se, N,

wherein the metal M is a transition metal, preferably W or Mo;




type 65b`

wherein the structural elements a-f can mean: a = -$CR_1R_2$-, b = -$CR_3R_4$-, c = -$CR_5R_6$-, d = -$CR_7R_8$-, e = -$CR_9R_{10}$- and f = $CR_{11}R_{12}$, where $R_1$, $R_2$, $R_3$, $R_4$, $R_5$, $R_6$, $R_7$, $R_8$, $R_9$, $R_{10}$, $R_{11}$ and $R_{12}$ are hydrogen, $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, preferably $R_1$, $R_3$, $R_5$, $R_7$, $R_9$, $R_{11}$ = H and $R_2$, $R_4$, $R_6$, $R_8$, $R_{10}$, $R_{12}$ = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, the structure 65b with $R_1$, $R_2$, $R_3$, $R_4$, $R_5$, $R_6$, $R_7$, $R_8$, $R_9$, $R_{10}$, $R_{11}$ and $R_{12}$ = H being excluded from this, the ligand with $R_9$, $R_{10}$, $R_{11}$, and $R_{12}$ = phenyl, methyl, allyl, $RSCH_2$- and $ROCH_2$- being excluded from this, the ligand with $R_9$ = phenyl, $R_{10}$ = H, $R_{11}$ = phenyl, $R_{12}$ =

H being excluded from this, the ligand with $R_1$ = phenyl being excluded from this, the ligand with $R_5$, $R_6$, $R_7$, $R_8$ = phenoxy being excluded from this, wherein

in the structural elements c and/or d, C can be replaced by Si, wherein

a or b or e or f can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, wherein

a and f or b and e can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl,

wherein the bonds a-c, b-d, c-e and d-f, but not simultaneously a-c and c-e and not simultaneously b-d and d-f can be unsaturated,

wherein the bonds a-c, b-d, c-e and d-f can be part of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein

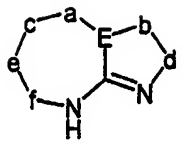
the bonds a-c, b-d, c-e and d-f can be part of an aromatic or condensed aromatic ring system which can also contain the heteroelements O, S, Se, N, the ligand in which a-c, b-d, c-e and d-f are components of benzene being excluded from this,

wherein the atom E is an element from the main group, preferably selected from the group N, P, As, Sb, though without being limited to these,

wherein the structural element a-E-b can be a component of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, excluding from this the ligand with a-E-b = component of cyclopentyl and pyranyl with $R_9$ to $R_{12}$ = alkyl, wherein

the structural element a-E-b can optionally be a component of an aromatic ring system which can also contain the heteroelements O, S, Se, N,

wherein the metal M is a transition metal, preferably W or Mo;




type 65c`

wherein the structural elements a-f can mean: a = -$CR_1R_2$-, b = -$CR_3R_4$-, c = -$CR_5R_6$-, d = -$CR_7R_8$-, e = -$CR_9R_{10}$- and f = $CR_{11}R_{12}$, where $R_1$, $R_2$, $R_3$, $R_4$, $R_5$, $R_6$, $R_7$, $R_8$, $R_9$, $R_{10}$, $R_{11}$ and $R_{12}$ can, at the same time or independently from one another, be H, $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, preferably $R_1$, $R_3$, $R_5$, $R_7$, $R_9$, $R_{11}$ = H and $R_2$, $R_4$, $R_6$, $R_8$, $R_{10}$, $R_{12}$ = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, the ligand with $R_1$ to $R_{12}$ = H being excluded from this, or

at c or e, C can be replaced by Si, wherein

a or b or d or f can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, wherein

a and d or band f can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl,

wherein the bonds a-c, c-e, e-f and b-d, but not simultaneously a-c, c-e and e-f and not simultaneously a-c and c-e and not simultaneously c-e and e-f can be unsaturated,

wherein the bonds a-c, c-e, e-f and b-d can be part of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein

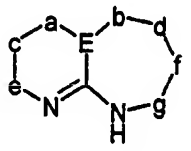
the bonds a-c, c-e, e-f and b-d can be part of an aromatic or condensed aromatic ring system which can also contain the heteroelements O, S, Se, N, the ligand with E = N and simultaneously e-f and/or b-d as part of benzene or naphthalene being excluded from this, the

ligand with E = N and simultaneously $R_7 = R_8$ = phenyl being excluded from this, the ligand with E = N and $R_3$ = phenyl, benzyl being excluded from this

wherein the atom E is an element from the main group, preferably selected from the group N, P, As, Sb, though without being limited to these, the ligand with E=N and simultaneously the seven-membered ring with more than one unsaturated bond being excluded from this

wherein the structural element a-E-b can optionally be a component of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein the structural element a-E-b can optionally be a component of an aromatic ring system which can also contain the heteroelements O, S, Se, N,

wherein the metal M is a transition metal, preferably W or Mo;




Type 65d`

wherein the structural elements a-g can mean: a = $-CR_1R_2-$, b = $-CR_3R_4-$, c = $-CR_5R_6-$, d = $-CR_7R_8-$, e = $-CR_9R_{10}-$, f = $CR_{11}R_{12}$ and g = $CR_{13}R_{14}$, where $R_1$, $R_2$, $R_3$, $R_4$, $R_5$, $R_6$, $R_7$, $R_8$, $R_9$, $R_{10}$, $R_{11}$, $R_{12}$, $R_{13}$ and $R_{14}$ can, at the same time or independently from one another, be H, $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, preferably, $R_1$, $R_3$, $R_5$, $R_7$, $R_9$, $R_{11}$, $R_{13}$ = H and $R_2$, $R_4$, $R_6$, $R_8$, $R_{10}$, $R_{12}$, $R_{14}$ = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, - $NR_2$ or -OR, or

at c, d and f, though not d and f simultaneously, C can be replaced by Si, wherein

a or b or e or g can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl, wherein

a and g or b and e can be NR with R = $C_1$-$C_{20}$ alkyl, $C_1$-$C_{20}$ cycloalkyl, $C_1$-$C_{20}$ alkenyl, $C_1$-$C_{20}$ alkinyl, aryl, heteroaryl,

wherein the bonds a-c, c-e, b-d, d-f and f-g, but not simultaneously a-c and c-e, and not simultaneously b-d, d-f and f-g, and not simultaneously b-d and d-f, and not simultaneously d-f and f-g, can be unsaturated, the ligand in which b-d and f-g are simultaneously unsaturated being excluded from this,

wherein the bonds a-c, c-e, b-d, d-f and f-g can be part of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein

the bonds a-c, c-e, b-d, d-f and f-g can be part of an aromatic or condensed aromatic ring system which can also contain the heteroelements O, S, Se, N, the ligand in which c-e and f-g are simultaneously part of a benzene ring being excluded from this,

wherein the atom E is an element from the main group, preferably selected from the group B, C, N, O, Si, P, S, As, Se, Sb, Te, particularly preferably selected from the group S, Se, N, P, though without being limited to these,

wherein the structural element a-E-b can optionally be a component of a saturated or unsaturated ring system which can also contain the heteroelements O, S, Se, N, P, Si, Ge, Sn, wherein

the structural element a-E-b can optionally be a component of an aromatic ring system which can also contain the heteroelements O, S, Se, N,

wherein the metal M is a transition metal, preferably W or Mo.